CLAIMS

The invention claimed is:

1. A deposition apparatus, comprising:

a substrate susceptor for receiving a semiconductor wafer substrate;

one or more heating sources for providing thermal energy to the substrate;

a radiation detector;

a radiation conduit proximate a region of a substrate received in the substrate susceptor and configured to channel radiation from said region of the substrate to the detector, the detector being configured to receive the radiation from the conduit and output one or more data signals in response to the radiation; and

a signal processor in data communication with the detector and configured to process at least one data signal from the detector and to correlate the data signal with a temperature of said region of the substrate.

2. The apparatus of claim 1 wherein the radiation conduit extends through the susceptor.

3. The apparatus of claim 1 wherein:

the susceptor is configured to receive a substantially circular semiconductor substrate;

the substrate is defined to comprise a plurality of annular regions extending radially inwardly of one another;

a plurality of the radiation conduits are provided, with at least one of the radiation conduits being associated with each of the annular regions; and

the signal processor is utilized to estimate temperatures of each of the annular regions.

4. The apparatus of claim 3 configured to spin the susceptor having the substrate received therein, and wherein:

the heating sources provide thermal energy to the substrate as it is spinning;

the radiation conduits channel radiation from the annular regions of the substrate as the substrate is spinning; and

the signal processor estimates temperatures of the annular regions as the substrate is spinning.

5. The apparatus of claim 4 wherein the conduits comprise first and second conduit components; the first conduit components spinning with the substrate and susceptor, and the second conduit components being stationary relative to the spinning substrate and susceptor and being configured to receive radiation from the first conduit components and channel the radiation to the detector.

6. The apparatus of claim 5 wherein the second conduit components are in one-to-one correspondence with the first conduit components.

7. The apparatus of claim 5 wherein the second conduit components are not in one-to-one correspondence with the first conduit components.

8. The apparatus of claim 5 wherein the first conduit components extend through the susceptor.

9. The apparatus of claim 1 wherein the semiconductor wafer has a front side over which a material is to be deposited and a back side facing the susceptor and in opposing relation to the front side, and wherein the conduit detects radiation from the back side of the semiconductor wafer.

10. The apparatus of claim 1 wherein the radiation is infrared radiation, and wherein the conduit is a fiber.

11. A method of assessing the temperature of a semiconductor wafer substrate within a deposition apparatus, comprising:

providing a deposition apparatus having a substrate susceptor for receiving a semiconductor wafer substrate, having a radiation detector, having a plurality of radiation conduits proximate a substrate received in the substrate susceptor and configured to channel radiation from regions of the substrate to the detector, and having a signal processor in data communication with the detector, wherein the detector is configured to receive the radiation from the conduits and output data signals in response to the radiation, and wherein the signal processor is configured to process at least some of the data signals from the detector and to correlate the data signals with temperatures of the regions of the substrate;

providing a semiconductor wafer substrate received by the susceptor, the substrate being defined to comprise a plurality of annular regions extending radially inwardly of one another;

spinning the substrate and susceptor;

while the substrate and susceptor are spinning:

channeling the radiation from the regions of the substrate through the radiation conduits and to the detector; the detector sending data signals to the signal processor in response to the radiation; and

processing the data signals with the signal processor to assess the temperatures of the regions of the substrate.

12. The method of claim 11 wherein:

the conduits comprise first and second conduit components;

the first conduit components are spun with the substrate and susceptor; and

the second conduit components are stationary relative to the spinning substrate and susceptor and are configured to receive radiation from the first conduit components and channel the radiation to the detector.

13. The method of claim 12 wherein the second conduit components are in one-to-one correspondence with the first conduit components.

14. The method of claim 12 wherein the second conduit components are not in one-to-one correspondence with the first conduit components.

15. The method of claim 12 wherein the first conduit components extend through the susceptor.

16. An apparatus configured for deposition of epitaxial semiconductor material, comprising:

a chamber within which the deposition occurs;

a flow line system configured to combine first and second gasses to form a mixture and to direct the mixture to the chamber, the flow of material within the flow line system being defined to be downstream from a location where the first and second gasses are combined to the chamber; and

at least one of a mass flow controller and a mass flow meter downstream of the location where the first and second gasses are combined, where the mass flow controller is other than a simple valve.

17. The apparatus of claim 16 comprising a mass flow meter downstream of the location where the first and second gasses are combined.

18. The apparatus of claim 16 comprising a mass flow controller downstream of the location where the first and second gasses are combined.

19. The apparatus of claim 18 wherein the mass flow controller is an analogue mass flow controller.

20. The apparatus of claim 16 comprising both a mass flow meter and a mass flow controller downstream of the location where the first and second gasses are combined.

21. The apparatus of claim 16 wherein the first gas comprises dichlorosilane and the second gas comprises H_2.

22. The apparatus of claim 21 further comprising at least one additional gas besides the first and second gasses; said at least one additional gas comprising a dopant or dopant precursor and being combined with the first and second gasses at the location where the first and second gases are combined with one another.

23. An apparatus configured for deposition of epitaxial semiconductor material, comprising:

a chamber within which the deposition occurs;

a first source containing first gas;

a second source containing second gas, the second gas being different from the first gas;

a flow line system configured to direct the first and second gasses from the first and second sources to a location where the first and second gasses are combined to form a mixture, to split the mixture amongst at least two flow paths which flow to the chamber, and to direct the mixture along the at least two flow paths to the chamber, the flow of material within the flow line system being defined to be downstream from the first and second sources to the chamber; and

at least one of a mass flow controller and a mass flow meter downstream of the location where the first and second gasses are combined, where the mass flow controller is other than a simple valve.

24. The apparatus of claim 23 comprising a mass flow meter downstream of the location where the first and second gasses are combined.

25. The apparatus of claim 23 comprising a mass flow controller downstream of the location where the first and second gasses are combined.

26. The apparatus of claim 25 wherein the mass flow controller is an analogue mass flow controller.

27. The apparatus of claim 23 comprising both a mass flow meter and a mass flow controller downstream of the location where the first and second gasses are combined.

28. The apparatus of claim 23 wherein the at least two flow paths which flow to the chamber are a first path and a second path, and comprising a first mass flow meter along the first path and a second mass flow meter along the second path.

29. The apparatus of claim 23 wherein the at least two flow paths which flow to the chamber are a first path and a second path, and comprising a first mass flow controller along the first path and a second mass flow controller along the second path.

30. The apparatus of claim 23 wherein the at least two flow paths which flow to the chamber are a first path and a second path; the apparatus comprising a first mass flow controller and a first mass flow meter along the first path, and comprising a second mass flow controller and a second mass flow meter along the second path.

31. The apparatus of claim 23 wherein the first gas comprises dichlorosilane and the second gas comprises H_2.

32. The apparatus of claim 31 further comprising at least one additional gas besides the first and second gasses; said at least one additional gas comprising a dopant or dopant precursor and being combined with the first and second gasses prior to separating the mixture of the first and second gasses along said at least two flow paths.

33. The apparatus of claim 31 comprising a plurality of the chambers and further comprising:

a first header within the flow line system which splits the first gas into separate channels which separately combine with the second gas to form separate mixtures directed toward separate chambers of the plurality of chambers;

a second header within the flow line system which splits the second gas into separate channels which separately combine with the first gas to form separate mixtures directed toward separate chambers of the plurality of chambers; and

at least one of a mass flow controller and a mass flow meter upstream of the first header, where the mass flow controller is other than a simple valve.

34. The apparatus of claim 33 wherein the first gas is H_2.

35. The apparatus of claim 33 further comprising at least one of a mass flow controller and a mass flow meter upstream of the second header, where the mass flow controller is other than a simple valve.

36. An apparatus configured for deposition of epitaxial semiconductor material, comprising:

a plurality of chambers within which the deposition occurs;

a first source containing first gas;

a second source containing second gas, the second gas being different from the first gas;

a flow line system configured to direct the first and second gasses from the first and second sources to a location where the first and second gasses are combined to form a mixture, to split the mixture amongst at least two flow paths which flow to the chamber, and to direct the mixture along the at least two flow paths to the chamber, the flow of material within the flow line system being defined to be downstream from the first and second sources to the chamber;

a first header within the flow line system which splits the first gas into separate channels which separately combine with the second gas to form separate mixtures directed toward separate chambers of the plurality of chambers;

a second header within the flow line system which splits the second gas into separate channels which separately combine with the first gas to form separate mixtures directed toward separate chambers of the plurality of chambers; and

at least one of a mass flow controller and a mass flow meter upstream of the first header, where the mass flow controller is other than a simple valve.

37. The apparatus of claim 36 wherein the first gas comprises H_2 and the second gas comprises dichlorosilane.

38. The apparatus of claim 37 further comprising at least one additional gas besides the first and second gasses; said at least one additional gas comprising a dopant or dopant precursor and being combined with the first and second gasses prior to separating the mixture of the first and second gasses along said at least two flow paths.

39. A method for deposition of epitaxial semiconductor material, comprising:

providing an apparatus comprising a chamber within which the deposition occurs;

providing a semiconductor wafer substrate within the reaction chamber;

providing a first source containing first gas;

providing a second source containing second gas, the second gas being different from the first gas;

providing a flow line system configured to direct the first and second gasses from the first and second sources to a location where the first and second gasses are combined to form a mixture, to split the mixture amongst at least two flow paths which flow to the chamber, and to direct the mixture along the at least two flow paths to the chamber, the flow of material within the flow line system being defined to be downstream from the first and second sources to the chamber; and

providing at least one of a mass flow controller and a mass flow meter downstream of the location where the first and second gasses are combined, where the mass flow controller is other than a simple valve; and

flowing the first and second gasses through the flow line system; and

utilizing the combined first and second gases to deposit an epitaxial semiconductor material over the substrate within the chamber.

40. The method of claim 39 wherein the deposited epitaxial semiconductor material comprises silicon.

41. The method of claim 39 wherein the deposited epitaxial semiconductor material consists essentially of silicon.

42. The method of claim 39 wherein the deposited epitaxial semiconductor material consists of silicon.

43. The method of claim 39 wherein the deposited epitaxial semiconductor material comprises doped silicon.

44. The method of claim 39 wherein the deposited epitaxial semiconductor material consists essentially of doped silicon.

45. The method of claim 39 wherein the deposited epitaxial semiconductor material consists of doped silicon.

46. The method of claim 39 wherein the deposited epitaxial semiconductor material comprises germanium.

47. The method of claim 39 wherein the deposited epitaxial semiconductor material comprises silicon/germanium.

48. The method of claim 39 wherein the deposited epitaxial semiconductor material consists essentially of silicon/germanium.

49. The method of claim 39 wherein the deposited epitaxial semiconductor material consists of silicon/germanium.